Hollenbeak[A13]	2002	USA	Community hospital	Surgical	1. Linear regression (normal) 2. Heckman's two-stage method 3. Matched comparison (1:1): mean 4. Unmatched comparison: mean	<Linear regression> + US$20,103 ($P < 0.001$) <Heckman's two-stage> + US$14,211 ($P = 0.0553$) <Matched> + US$19,579 ($P = 0.0001$) <Unmatched> + US$20,012 ($P = 0.0001$)	[Matched comparison] (1) Age, (2) Sex, (3) Diabetes, (4) Renal insufficiency, (5) Length of surgical procedure [Regression analysis] [Linear regression] (1) Intra-aortic balloon pump*, (2) Diabetes [Heckman's two-stage] (1) Intra-aortic balloon pump*, (2) Diabetes, (3) Hazard function (1. Obesity*, 2. Renal insufficiency*, 3. Connective tissue disease, 4. Antibiotic prophylaxis > 60 min, 5. OR duration >240 min, 6. Re-exploration for bleeding, 7. diabetes)
Jenney[A14]	2001	Australia	Tertiary hospital	Surgical	Matched comparison (1:1): mean	+A$12,419 [20,888 vs 8,468] ($P = 0.001$)	(1) Sex, (2) Age, (3) NNIS risk index scores, (4) No. of principal comorbidities
Hollenbeak[A15]	2001	USA	Mixed:3 hospitals	Surgical	Linear regression (normal)	+US$131,276 ($P < 0.001$)	(1) Karnofsky scale*, (2) Packed red blood cells*, (3) Cold ischaemia time, (4) HLA-A and -B mismatches, (5) Oedema*, (6) Sex, (7) Race
Plowman[A16]	2001	UK	General hospital	Mixed	Linear regression (gamma)	+£1,594 ($P < 0.05$)	(1) Age, (2) Sex, (3) Diagnosis, (4) No. of comorbidities, (5) Admission specialty, (6) Admission type
Reilly[A17]	2001	UK	Not stated	Surgical	Unmatched comparison (1:x): mean	+£1,743	NA
Hollenbeak[A18]	2000	USA	Community hospital	Surgical	Linear regression (normal)	+US$18,938 ($P < 0.001$)	(1) Intra-aortic balloon pump*, (2) Age*, (3) Smoker, (4) COPD, (5) Renal insufficiency, (6) Obese, (7) Preoperative LOS, (8) Re-exploration for bleeding, (9) Clamp duration, (10) Surgery duration, (11) CHF, (12) Diabetes
Kirkland[A19]	1999	USA	Community hospital	Surgical	Matched comparison (1:1): median	+US$3,089 [7,486 vs 3,842] ($P < 0.05$)	(1) Procedure code, (2) NNIS risk index, (3) Age, (4) Date of surgery, (5) Surgeon
Zoutman[A20]	1998	Canada	University hospital	Surgical	Standardized case review (AEP): mean & median	Mean: +CAD3,937 Median: +CAD1,737	Not specified
VandenBergh[A21]	1996	Netherlands	University hospital	Surgical	Unknown: median	<Postoperative> + US$9,320 [14,560 vs 5,240] ($P < 0.001$)	Not specified
Coello[A22]	1993	UK	General hospital	Surgical	Matched comparison (1:1): mean	+£1,456	(1) Sex, (2) Age, (3) Surgical service, (4) Underlying condition or complication
Vegas[A23]	1993	Spain	Tertiary hospital	Surgical	Matched comparison (1:1): mean	+US$4,449 ($P < 0.01$)	(1) Primary diagnosis, (2) Operative procedure, (3) No intervention if the infected patient was not operated on, (4) Category of surgical prodecures classification, (5) Age, (6) Neoplastic or endocrine disease, (7) Elective and emergency procedures, (8) Duration at risk (LOS)
Lynch[A24]	1992	Scotland	Teaching hospital	Surgical	Matched comparison (1:1): mean	+£1,072 [2,680 vs 1,607]	(1) Age, (2) Sex, (3) Type of operation, (4) Surgeon
Boyce[A25]	1990	USA	University hospital	Surgical	Matched comparison (1:1): mean	+US$13,162 [25,957 vs 12,795] ($P = 0.0002$)	(1) DRG, (2) Age, (3) Sex, (4) Urgency of surgery, (5) Type of cardiac surgery, (6) No. of vessels bypassed, (7) Internal mammary artery graft, (8) Type of valve
Mugford[A26]	1989	Several countries	Mixed:several hospitals	Surgical	Unmatched comparison (1:x): mean	+£716 [1,435 vs 719]	NA

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Table II (*continued*)

First author	Year	Country	Type of setting	Type of patients	Analytical methodology	Additional cost to HAI (SSI), if stated [infected vs uninfected]	Matching variables or regression analysis covariates
Fabry[A27]	1982	France	Teaching hospital	Surgical	Matched comparison (1:*x*): mean	+FF4,258	(1) Age, (2) Surgical procedure, (3) Level of medical risk (infection at entry, heavier surgery, and associated chronic conditions)
Scheckler[A28]	1980	USA	Teaching hospital	Admissions	Case review: mean	+US$1,329	NA
Bloodstream infection							
Herwaldt[A1]	2006	USA	Mixed:2 hospitals	Surgical	Linear regression (log)	<UTI & RTI & BSI> <Non-fatal> + US$6,536 [8,435 vs 1,899] ($P<0.001$) <Fetal> + US$3,249 [5,148 vs 1,899] ($P<0.001$)	(1) Karnofsky score*, (2) NNIS risk index*, (3) No. of comorbid illnesses*, (4) Obesity*, (5) Preoperative LOS*, (6) Age*, (7) Interaction of type of surgery and the McCabe and Jackson classification*
Vogel[A2]	2006	USA	University hospital	Surgical	Rregression	+US$86,500 [247,440 vs 160,940] ($P<0.001$)	Not specified
Warren[A29]	2006	USA	Suburban hospital	Patients with CVC – ICU	Linear regression (log) & matched comparison by propensity score: median	<cABSI: Regression> + US$11,971 [29,256 vs 17,285] ($P<0.05$) <cABSI: Matched comparison > US$26,241 [54,242 vs 26,001] (*P*: unknown)	[Matched comparison] (1) Duration at risk (LOS), (2) CHF, (3) Age, (4) APACHE II, (5) Mechanical ventilation [Regression analysis] (1) APACHE II*, (2) CHF*, (3) Haemodialysis*, (4) Ventilator days*, (5) Age, (6) Sex, (7) Chronic obstructive pulmonary disease, (8) Cancer, (9) Diabetes, (10) Sepsis, (11) Surgical procedure, (12) Renal failure
Laupland[A30]	2006	Canada	Mixed:3 hospitals	Intensive care	Matched comparison (1:1): median & mean	Median: +CAD12,321 [85,137 vs 67,879] ($P<0.05$) Mean: +CAD16,867 [103,987 vs 87,120] (*P*: unknown)	(1) Regional ICU location, (2) Surgical/medical diagnosis, (3) Chronic renal dialysis dependence, (4) Duration at risk (LOS), (5) Age, (6) Sex, (7) APACHE II, (8) Hospital LOS
Blot[A31]	2005	Belgium	University hospital	Intensive care	Linear regression (normal) & matched comparison (1:2 or 1:1): median	<cABSI: Regression> + €16,814 ($P<0.001$) <cABSI: Matched comparison> + €13,585 [51,405 vs 37,820] ($P<0.001$)	[Matched comparison] (1) APACHE II, (2) Diagnostic category, (3) Duration at risk (ICU LOS), (4) CVC [Regression analysis] (1) LOS*, (2) Age, (3) APACHE II*, (4) Surgical or medical admission diagnosis, (5) Need for mechanical ventilation, (6) Need for renal replacement therapy*, (7) Need for vasopressors, (8) Need for inotropic treatments
Sheng[A6]	2005	Taiwan	University hospital	Admissions	Matched comparison (1:1): median	+T$101,536 [323,479 vs 199,365] ($P<0.001$)	(1) Age, (2) Sex, (3) Underlying medical illness, (4) Types of surgery, (5) Diagnosis at admission, (6) Admission date, (7) Types of wards and disease severity
Elward[A32]	2005	USA	Tertiary hospital	Admissions – PICU	Linear regression (log)	+US$39,219 [45,615 vs 6,396] ($P<0.001$)	(1) PRISM II*I, (2) Ventilator days*, (3) CHF*, (4) Transplant*, (5) Underlying lung disease*, (6) Age
Payne[A33]	2004	USA	Mixed:17 hospitals	Inborn and outborn infants	Generalised estimating equations (log)	+US$5,875 [128,887 vs 123,012] ($P=0.141$) ~ +US$12,480 [94,060 vs 81,580] ($P=0.009$)	(1) Birth weight, (2) Birth location, (3) Sex, (4) Race, (5) Prenatal care, (6) Antenatal steroids, (7) Multiple birth, (8) Apgar score, (9) Respiratory distress syndrome, (10) CLD, (11) Necrotizing enterocolitis (NEC), (12) NEC surgery, (13) Other surgery, (14) Mechanical ventilation

Please cite this article in press as: Fukuda H, et al., Variations in analytical methodology for estimating costs of hospital-acquired infections: a systematic review, Journal of Hospital Infection (2010), doi:10.1016/j.jhin.2010.10.006

Wisplinghoff[A34]	2003	Germany	University hospital	Patients with a haematological malignancy	Matched comparison (1:1): mean	+US$3,170	(1) Date of admission, (2) Duration at risk (LOS), (3) Age, (4) Sex, (5) Type and stage of underlying malignancy, (6) Radiation therapy (7) Duration and severity of neutropenia prior to BSI
Rosenthal[A35]	2003	Argentina	Mixed:3 hospitals	Patients with CVC – ICU	Matched comparison (1:1): mean	<cVC-associated BSI> + US$4,888 [7,972 vs 3,083]	(1) Hospital, (2) ICU type, (3) Year of admission, (4) LOS, (5) Sex, (6) Age, (7) ASIS
Orsi[A36]	2002	Italy	University hospital	Admissions	Matched comparison (1:2): mean	+€16,356	(1) Duration at risk (LOS), (2) Primary diagnosis, (3) Ward of admission, (4) CVC, (5) Age, (6) Sex
Liu[A37]	2002	Taiwan	Tertiary hospital	Surgical	Matched comparison (1:2): median	+T$66,302 [131,584 vs 65,282] ($P < 0.001$)	(1) Primary diagnosis at admission, (2) Date of admission, (3) Age, (4) Duration at risk (LOS), (5) Sex, (6) No. discharge diagnoses
Plowman[A16]	2001	UK	General hospital	Mixed	Linear regression (gamma)	+£6,209 ($P < 0.05$)	(1) Age, (2) Sex, (3) Diagnosis, (4) No. of comorbidities, (5) Admission specialty, (6) Admission type
Dimick[A38]	2001	USA	Tertiary hospital	Surgical – ICU	Linear regression (log)	<cABSI> + US$56,167 [102,973 vs 46,806] ($P = 0.001$)	(1) APACHE III*, (2) Age*, (3) Sex, (4) Univeriate factors of significance
Slonim[A39]	2001	USA	Children's hospital	Admissions – PICU	Matched comparison (1:1): mean	+US$58,344 [99,177 vs 45,038] ($P < 0.001$)	(1) Age, (2) PRISM III, (3) Primary diagnosis, (4) Admission date
Rello[A40]	2000	Spain	Tertiary hospital	Admissions – ICU	Matched comparison (1:1): mean	+€3,124 [10,052 vs 6,914]	(1) Level of severity, (2) Underlying disease, (3) Age, (4) Duration at risk (LOS)
Digiovine[A41]	1999	USA	University hospital	Medical – ICU	Matched comparison (1:1): median	+US$15,965 [60,650 vs 36,899] ($P < 0.001$)	(1) Predicted mortality, (2) Sex, (3) Age, (4) Race, (5) LOS, (6) Admission during the study period, (7) Admitting diagnosis, (8) Chronic health
Abramson[A42]	1999	USA	University hospital	Admissions	Matched comparison (1:1): median	<MSSA> + US$9,661 ($P < 0.01$) <MRSA> + US$27,083 ($P < 0.01$)	(1) Primary diagnosis, (2) No. of secondary diagnosis, (3) Age, (4) Sex, (5) Hospital ward
Pittet[A43]	1994	USA	University hospital	Surgical intensive care	Matched comparison (1:1): mean	+US$33,268 [91,241 vs 57,973] ($P < 0.01$)	(1) Primary diagnosis for admission, (2) Age, (3) Sex, (4) Duration at risk (LOS), (5) No. of discharge diagnoses
Pneumonia/VAP							
Vogel[A2]	2006	USA	University hospital	Surgical	Regression	<VAP> + US$89,187 [232,080 vs 142,893] ($P < 0.001$)	Not specified
Gavalda[A3]	2006	Spain	Teaching hospital	Mixed	Standardised case review (AEP): mean	<Pneumonia & RTI> +€358	NA
Thompson[A44]	2006	USA	Mixed: 994 hospitals	Surgical	Linear regression (normal)	<Pneumonia> + US$28,161 ($P < 0.05$)	(1) Surgical procedure, (2) Age, (3) Sex, (4) Race
Cocanour[A45]	2005	USA	Tertiary hospital	Ventilated patients – ICU	Matched comparison (1:1): mean	<VAP> + US$57,158 [82,195 vs 25,037] ($P < 0.05$)	(1) Age, (2) Injury severity score
Rosenthal[A46]	2005	Argentina	Mixed:3 hospitals	Intensive care	Matched comparison (1:1): mean	<Pneumonia> + US$2,253 [4,946 vs 2,694] ($P < 0.001$)	(1) Hospital, (2) ICU type, (3) Admission year, (4) LOS, (5) Sex, (6) Age, (7) ASIS at admission
Hugonnet[A47]	2004	Switzerland	University hospital	Ventilated patients – ICU	Matched comparison (1:1): mean	<VAP> + US$10,450 [24,727 vs 17,438] ($P < 0.05$)	(1) No. of discharge diagnoses, (2) Duration at risk (ventilation), (3) Age, (4) Diagnosis at admission, (5) Sex, (6) Study period
van Nieuwenhoven[A48]	2004	Netherlands	University hospital	Intensive care	Unknown: mean	<VAP> + US$15,623 [29,360 vs 13,737]	Not specified
Warren[A49]	2003	USA	Tertiary hospital	Ventilated patients – ICU	Linear regression (log)	<VAP> + US$11,897 [27,033 vs 15,136] ($P < 0.05$)	(1) CHF*, (2) Corticosteroid use*, (3) APACHE II*, (4) Tracheostomy*, (5) No. of CVC*, (6) Bacteraemia*, (7) H2-histamine antagonist use*
Dietrich[A50]	2002	Germany	University hospital	Admissions	Matched comparison (1:1): mean	<Pneumonia> + DM29,610	(1) Severity of disease, (2) Age, (3) Primary ward, (4) Status of ventilation, (5) Immunosuppression, (6) Sex, (7) Duration at risk (LOS)
Merchant[A51]	1998	India	Teaching hospital	Admissions	Unmatched comparison (1:x): mean	<Pneumonia> + US$496	None
Kappstein[A52]	1992	Germany	University hospital	Ventilated patients – ICU	Matched comparison (1:x): mean	<VAP> + DM14,253 (US$8,800)	(1) Underlying condition, (2) Age, (3) Duration at risk (ventilation), (4) Time that control patients were subjected to the risk of acquiring nosocomial infections

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Table II (*continued*)

First author	Year	Country	Type of setting	Type of patients	Analytical methodology	Additional cost to HAI (SSI), if stated [infected vs uninfected]	Matching variables or regression analysis covariates
Scheckler[A28]	1980	USA	Teaching hospital	Admissions	Case review: mean	<Pneumonia> + US$878	NA
Urinary tract infection							
Herwaldt[A1]	2006	USA	Mixed:2 hospitals	Surgical	Linear regression (log)	<UTI & RTI & BSI> <Non-fatal> + US$6,536 [8,435 vs 1,899] ($P < 0.001$) <Fetal> + US$3,249 [5,148 vs 1,899] ($P < 0.001$)	(1) Karnofsky score*, (2) NNIS risk index*, (3) No. of comorbid illnesses*, (4) Obesity*, (5) Preoperative LOS*, (6) Age* (7) Interaction of type of surgery and the McCabe and Jackson classification*
Gavalda[A3]	2006	Spain	Teaching hospital	Mixed	Standardised case review (AEP): mean	+€1,792	NA
Sheng[A6]	2005	Taiwan	University hospital	Admissions	Matched comparison (1:1): median	+T$114,662 [354,608 vs 159,953] ($P < 0.001$)	(1) Age, (2) Sex, (3) Underlying medical illness, (4) Types of surgery, (5) Diagnosis at admission, (6) Admission date, (7) Types of wards and disease severity
Lai[A53]	2002	USA	University hospital	Admissions	Case review: mean & median	<cAUTI>Mean: +US$1,214 <cAUTI>Median: +US$614	NA
Tambyah[A54]	2002	USA	University hospital	Admissions	Case review: mean	<cAUTI> + US$589	NA
Plowman[A16]	2001	UK	General hospital	Mixed	Linear regression (gamma)	+£1,122 ($P < 0.05$)	(1) Age, (2) Sex, (3) Diagnosis, (4) No.of comorbidities, (5) Admission specialty, (6) Admission type
Coello[A22]	1993	UK	General hospital	Surgical	Matched comparison (1:1): mean	+£467	(1) Sex, (2) Age, (3) Surgical service, (4) Underlying condition or complication
Fabry[A27]	1982	France	Teaching hospital	Surgical	Matched comparison (1:x): mean	+FF2,726	(1) Age, (2) Surgical procedure, (3) Level of medical risk (infection at entry, heavier surgery, and associated chronic conditions)
Givens[A55]	1980	USA	Teaching hospital	Surgical	Matched comparison (1:x): mean	<cAUTI> + US$558	NA
Scheckler[A28]	1980	USA	Teaching hospital	Admissions	Case review: mean	+US$146	NA
Respiratory tract infection							
Herwaldt[A1]	2006	USA	Mixed:2 hospitals	Surgical	Linear regression (log)	<UTI & RTI & BSI> <Non-fatal> + US$6,536 [8,435 vs 1,899] ($P < 0.001$) <Fetal> + US$3,249 [5,148 vs 1,899] ($P < 0.001$)	(1) Karnofsky score*, (2) NNIS risk index*, (3) No. of comorbid illnesses*, (4) Obesity*, (5) Preoperative LOS*, (6) Age*, (7) Interaction of type of surgery and the McCabe and Jackson classification*
Gavalda[A3]	2006	Spain	Teaching hospital	Mixed	Standardised case review (AEP): mean	<Pneumonia & RTI> +€358	NA
Sheng[A6]	2005	Taiwan	University hospital	Admissions	Matched comparison (1:1): median	+T$117,100 [368,435 vs 180,059] ($P < 0.001$)	(1) Age, (2) Sex, (3) Underlying medical illness, (4) Types of surgery, (5) Diagnosis at admission, (6) Admission date, (7) Types of wards and disease severity
Plowman[A16]	2001	UK	General hospital	Mixed	Linear regression (gamma)	+£2,080 ($P < 0.05$)	(1) Age, (2) Sex, (3) Diagnosis, (4) No. of comorbidities, (5) Admission specialty, (6) Admission type
Fabry[A27]	1982	France	Teaching hospital	Surgical	Matched comparison (1:x): mean	+FF2,060	(1) Age, (2) Surgical procedure, (3) Level of medical risk (infection at entry, heavier surgery, and associated chronic conditions)
General							
Gavalda[A3]	2006	Spain	Teaching hospital	Mixed	Standardised case review (AEP): mean	+€2,730	NA
Esatoglu[A56]	2006	Turkey	Clinics	Not stated	Matched comparison (1:1): mean	+US$2,027 [3,907 vs 1,524] ($P < 0.001$)	(1) Age, (2) Sex, (3) Clinic, (4) Primary diagnosis
Sanchez-Velazquez[A57]	2006	Mexico	National hospital	Intensive care	Matched comparison (1:2): median	+US$12,155	(1) Duration at risk (LOS), (2) Age, (3) APACHE II

Lazarus[A58]	2005	USA	Teaching hospital	Trauma admissions	Linear regression (log)	2.04 times	(1) Age, (2) Sex, (3) Injury Severity Score*
Noskin[A59]	2005	USA	Mixed: 986–994 hospitals	Admissions	Linear regression (log) & matched comparison (1:1): mean	Regression: +US$32,856 ($P<0.001$) Matched comparison: + US$36,119 ($P<0.001$)	[Matched comparison] (1) Hospital, (2) Age, (3) Sex, (4) Race, and (5) Comorbidity [Regression analysis] (1) Hospital (2) DRG, (3) Age, (4) Sex, (5) Race, (6) Payer, (7) Comorbidities
Sheng[A6]	2005	Taiwan	University hospital	Admissions	Matched comparison (1:1): median	+T$127,354 [363,425 vs 165,965] ($P<0.001$)	(1) Age, (2) Sex, (3) Underlying medical illness, (4) Types of surgery, (5) Diagnosis at admission, (6) Admission date, (7) Types of wards and disease severity
Chen[A60]	2005	Taiwan	Tertiary hospital	Intensive care	Linear regression (log)	+US$3,306 ($P<0.05$)	(1) LOS in ICU*, (2) Age, (3) Sex, (4) Service (medical or surgical), (5) APACHE II, (6) Albumin level*, (7) Pulmonary artery catheter*, (8) Mechanical ventilator*, (9) Urinary catheter*
Upton[A61]	2005	NZ	Specialised hospital	Surgical	Matched comparison (1:1): mean	+NZ$45,577 [76,104 vs 30,527] ($P<0.001$)	(1) Sex, (2) Age, (3) Surgical procedure, (4) Month of procedure, (5) Diabetes mellitus
Sheng[A62]	2005	Taiwan	Mixed:3 hospitals	Admissions	Matched comparison (1:1): mean	<Hospital 1> + US$5,335 [13,426 vs 8,092] ($P<0.001$) <Hospital 2> + US$5,058 [8,014 vs 2,955] ($P<0.001$)	(1) Age, (2) Sex, (3) Underlying medical illness and surgical operation, (4) Diagnosis at admission, (5) Admission date, (6) Ward, (7) Disease severity
Pirson[A63]	2005	Belgium	General hospital	Admissions	Matched comparison (1:all): mean	+€12,853 [18,288 vs 5,440] ($P<0.001$)	(1) DRG
Watters[A64]	2004	Ireland	Tertiary hospital	Surgical	Matched comparison (1:x): mean	+£8,955 [11,795 vs 2,840]	(1) Procedure
Piednoir[A65]	2003	France	University hospital	Child admissions	Matched comparison (1:1): mean	+€1,930 [3,097 vs 1,167]	(1) Primary diagnosis for admission, (2) Admission to the infant ward during the same period, (3) Age, (4) Sex, (5) Duration at risk (LOS), (6) No. of discharge diagnoses
Roberts[A66]	2003	USA	Teaching hospital	Admissions	Linear regression (normal)	+US$15,275 ($P<0.001$)	(1) APACHE III*, (2) ICU care*
Song[A67]	2003	USA	University hospital	Admissions	Matched comparison (1:1): median	+US$81,208	(1) Age, 2) Year of admission, (3) Duration at risk (LOS), (4) Principal diagnosis at admission, (5) Primary procedure, (6) All patient refined – DRG
Zhan[A68]	2003	USA	Mixed: 994 hospitals	Not stated	Matched comparison (1:x): mean & linear regression (mixed-effect model)	<Postoperative sepsis>**Mean: + US$57,727 ($P<0.001$)**<Selected infection due to medical care> **Mean: +US$38,656 ($P<0.001$)	[Matched comparison]**(1) Hospitals, (2) DRG, (3) Sex, (4) Race, 5) Age, (6) Comorbidity **[Regression analysis]**Not specified
Oncul[A69]	2002	Turkey	Teaching hospital	Burned admissions	Matched comparison (1:x): mean	+US$502 [579 vs 77] ($P=0.001$)	(1) Age, (2) Sex, (3) Medical and surgical setting, (4) Total burn surface area
Onen[A70]	2002	Turkey	Surgery clinic	Child admissions	Matched comparison (1:1): mean	+US$452 [963 vs 511] ($P<0.001$)	(1) Age, (2) Sex, (3) Primary illness
Mahieu[A71]	2001	Belgium	University hospital	Neonates in NICU	Matched comparison (1:1): mean	+€11,750 [24,722 vs 12,972] ($P<0.001$)	(1) Gestational age, (2) Patent ductus arteriosus, (3) Surgery, (4) Ventilator support
Plowman[A16]	2001	UK	General hospital	Mixed	Linear regression (gamma)	+£2,917 ($P<0.05$)	(1) Age, (2) Sex, (3) Diagnosis, (4) No. comorbidities, (5) Admission specialty, (6) Admission type
Khan[A72]	2001	Turkey	Tertiary hospital	Admissions	Matched comparison (1:1): mean	+US$442 [2,419 vs 1,977] (P-value: NS)	(1) Age, (2) Sex, (3) ICU location, (4) Principal diagnosis
Dominguez[A73]	2001	USA	Tertiary children's hospital	Admissions – PICU	Linear regression (normal) & matched comparison (1:1): mean	Regression: +US$50,362 ($P<0.001$)**Matched comparison: +US$32,040 [63,971 vs 32,291]	[Matched comparison]**(1) Diagnosis category, (2) Duration at risk (LOS), (3) PRISM **[Regression analysis]**(1) Age, (2) Severity of illness, (3) Organ system failure, (4) Diagnosis, (5) Chronic disease, (6) Ventilator use, (7) Vascular catheter use, (8) Referral source, (9) Sex, (10) Complication categories

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Please cite this article in press as: Fukuda H, et al., Variations in analytical methodology for estimating costs of hospital-acquired infections: a systematic review, Journal of Hospital Infection (2010), doi:10.1016/j.jhin.2010.10.006

Table II (*continued*)

First author	Year	Country	Type of setting	Type of patients	Analytical methodology	Additional cost to HAI (SSI), if stated [infected vs uninfected]	Matching variables or regression analysis covariates
Macartney[A74]	2000	USA	Children's hospital	Child admissions	Matched comparison (1:1): mean	+US$45,335	(1) RSV season, (2) Principal discharge diagnosis, (3) No. of secondary diagnoses, (4) Approximate age
Chaix[A75]	1999	France	University hospital	Medical – ICU	Matched comparison (1:1): median & mean	Mean: +US$9,275 [30,225 vs 20,950] ($P = 0.004$) Median: +US$5,885 [24,525 vs 17,105] ($P = 0.003$)	(1) Age, (2) McCabe and Jackson classification, (3) Simplified acute physiology score, (4) No. of organ system failures at ICU admission, (5) Duration at risk (ICU LOS)
Orrett[A76]	1998	Trinidad and Tobago	Tertiary hospital	Admissions	Matched comparison (1:1): mean	+US$1,910	(1) Age, (2) Sex, (3) Operative procedures, (4) Services, (5) Discharge diagnoses
Yalcin[A77]	1997	Turkey	University hospital	Not stated	Matched comparison (1:1): mean	+US$1,582 [2,280 vs 698] ($P < 0.001$)	(1) Age, (2) Sex, (3) Medical and surgical setting, (4) Underlying disease
Leroyer[A78]	1997	France	Pediatric hospital	Neonates	Matched comparison (1:1): mean	+FF52,192 [502,837 vs 450,645] ($P = 0.03$)	(1) Birthweight, (2) Gestational age, (3) Admission route, (4) Previous stay in an ICU, (5) CVC
Wilcox[A79]	1996	UK	Teaching hospital	Admissions	Matched comparison (1:2): mean	+£4,107	(1) Word, (2) Date of admission, (3) Sex
Gray[A80]	1995	USA	Mixed:**2 hospitals	Admissions – NICU	Linear regression (normal)	+US$25,090	(1) Birth weight, (2) Score for Neonatal Acute Physiology, (3) Retrotransport
Vegas[A23]	1993	Spain	Tertiary hospital	Surgical	Matched comparison (1:1): mean	+US$2,850 ($P < 0.01$)	(1) Primary diagnosis, (2) Operative procedure, (3) No intervention if the infected patient was not operated on, (4) Category of surgical procedures classification, (5) Age, (6) Presence of neoplastic or endocrine disease, (7) Elective and emergency procedures, (8) Duration at risk (LOS)
Shulkin[A81]	1993	USA	University hospital	Surgical	Linear regression (normal)	+US$12,542 ($P < 0.01$)	Not specified
Li[A82]	1990	China	Specialised hospital	Surgical	Matched comparison (1:1): mean	+£290 [717 vs 427] ($P < 0.001$)	(1) Sex, (2) Underlying disease, (3) Surgical procedure, (4) Age, (5) Preoperative stay, (6) Duration at risk (LOS)
Taylor[A83]	1990	USA	Teaching hospital	Surgical	Linear regression (normal)	+US$41,559 ($P < 0.001$)	(1) Complication*, (2) Respiratory failure*, (3) Left ventricular failure requiring intra-aortic balloon counterpulsation*, (4) Death*
Wakefield[A84]	1988	USA	University hospital	Admissions	Standardized case review (AEP): mean & median	Mean: +US$3,198 Median: +US$1,058	NA
Nelson[A85]	1986	USA	Not stated	Surgical	Matched comparison (1:1): mean	+US$6,605 [14,443 vs 7,838]	(1) Type of operation, (2) Age, (3) Sex, (4) Date of operation, (5) Non-invasive procedure
Girard[A86]	1983	France	University hospital	Neonates hospitalized	Matched comparison (1:1): mean	+FF6,038 [25,170 vs 19,132] ($P < 0.001$)	(1) Hospital unit, (2) Birth weight, (3) Duration of pregnancy, (4) Diagnosis
DeClercq[A87]	1983	Belgium	Not stated	Admissions – ICU	Matched comparison (1:1): mean	+BF1,639 [3,442 vs 1,803]	(1) Sex, (2) Age, (3) Operative procedure, (4) Diagnosis
Haley[A88]	1981	USA	Mixed: 3 hospitals	Admissions	Standardized case r eview: mean	<Hospital 1> +US$680 <Hospital 2> +US$721 <Hospital 3> +US$671	NA
SchecklerA28	1980	USA	Teaching hospital	Admissions	Case review: mean	+US$636	NA
HaleyA89	1980	USA	General hospital	Admissions	Matched comparison (1:1): mean	+US$1,018 [1,733 vs 714]	(1) First discharge diagnosis, (2) Main procedure, (3) Second operative procedure, (4) Hospital service, (5) Sex, (6) Age

TB, Thai Baht; T$, New Taiwan dollar; FF, French franc; DM, Deutsche Mark; BF, Belgian franc.
HAI, hospital-acquired infection; SSI, surgical site infection; NNIS, National Nosocomial Infection Surveillance system; LOS, length of stay; AEP, acute eosinophilic pneumonia; NA, not applicable; ASA, American Society of Anesthesiologists; MSSA/MRSA, meticillin-susceptible/resistant *Staphylococcus aureus*; COPD, chronic obstructive pulmonary disease; CHF, congestive heart failure; DRG, diagnosis-related group; UTI, urinary tract infection; RTI, respiratory tract infection; BSI, bloodstream infection; CVC, central venous catheter; ICU, intensive care unit; CABSI, catheter-associated bloodstream infection; APACHE II, Acute Physiological Assessment and Chronic Health Evaluation; PRISM, Paediatric risk of mortality score; ASIS, American Spinal Injury Association; VAP, ventilator-associated pneumonia; NICU, neonatal ICU; PICU, paediatric ICU; RSV, respiratory syncytial virus.
*Significant variables.

Please cite this article in press as: Fukuda H, et al., Variations in analytical methodology for estimating costs of hospital-acquired infections: a systematic review, Journal of Hospital Infection (2010), doi:10.1016/j.jhin.2010.10.006

that of regression analysis.[18] Due to this high degree of variation in the published literature, the degree of influence of methodological approach on estimates remains unclear.

In recent years, there has been an increase in analyses that use models that make it possible to adjust for endogenous variables and confounding factors in linear regression models.[8,10,14] In a comparison of matched comparison analysis, linear regression analysis and Heckman's two-stage model, it was found that whereas the difference was not statistically significant, Heckman's two-stage model produced lower COHAI estimates than both of the other methods.[14] The lack of statistical significance supported the conclusion that matching and linear regression analyses could be used as valid methodologies. Graves has stated with regard to instrumental variable models that 'the conventional wisdom has been that the endogeneity between length of stay and lower respiratory tract infection should bias the traditional estimates upwards, not downwards'.[19]

A major issue in the matched comparisons approach is the trade-off required in the quality of matching: if matching is conducted with the utmost stringency, the exclusion of unused cases and controls can lead to selection bias. However, reducing the stringency for matching criteria may increase the number of possible matched references, but also result in insufficient accounting for detailed patient characteristics such as disease severity. The use of stepwise fashion matching and a scoring system has been recommended to increase the quality of matching, but this technique was used by only seven studies in our analysis.[20] Furthermore, while patient factors such as age and sex are used in virtually all of the matching comparison analyses, patient disease severity factors were used in less than half of these studies.

In order to evaluate the possible effects of bias, the proportion of successful matches should be reported as part of the results in all studies, using a ratio of the final number of infected cases used in analysis to the number of all original infected cases. Of the 53 studies that used matched comparisons, only 28 (52.8%) had reported the proportion of successful matches. Given its simplicity, we advocate the reporting of this indicator in all matched comparison analyses. Furthermore, the use of propensity scores as summaries of covariate information has been recommended, and analysts should endeavor to use this method if employing the matched comparisons approach.[18,21]

The shifts in analytic methodologies for COHAI estimates over the years have shown that analysts have started to lean towards regression analysis. More than half of the studies published post 2000 had used matched comparisons, and there was only a marginally significant difference between studies that had accounted for LOS and those that did not. LOS is a highly important factor to include in analysis, even in the matched comparisons method. In the 89 studies in our sample, only 27 (30.3%) had included LOS as a factor in COHAI estimation. This highlights the fact that the inclusion of time at risk variables has yet to become sufficiently adopted among analysts.

Based on an analysis of the citation rates of the studies in our sample using the ISI Web of Science® database, we found that studies using the more stringent methodology of regression analysis were not cited with a significantly higher frequency than studies that had less stringent methodologies (data not shown). This indicates the possibility that COHAI estimates with biases have been used in downstream analyses, and may have even have influenced decision-making by supporting inaccurate business cases.

The Society for Healthcare Epidemiology of America (SHEA) has produced guidelines that permit the extrapolation of estimates calculated from the published literature; we feel that this is a risky stance, as COHAI estimates have a high degree of uniqueness based on the particular conditions in which they were calculated.[22] There is a large degree of variation in costing scopes, unit costs per item, clinical practice variations for HAI treatment, and costing methodologies (actual costs vs RCC vs charges), and these factors have Q2 a direct and substantial influence on the resulting estimates (H. Fukuda, J. Lee, Y. Imanaka, unpublished data).

A limitation was that the dearth of detailed information concerning methodological approach might be due to space limitations set by the various journals. However, as these data are essential for editors, reviewers and readers to evaluate the quality of the methods used, the authors feel this information should be reported in all COHAI estimate studies.

Greater insight is needed on the characteristics and limitations of different COHAI estimation methodologies, as this would allow analysts to identify and select more accurate methods, as well as employ the correct tools for avoiding biases. More transparency in the reporting of methodologies and limitations would provide readers with the necessary information to evaluate the appropriateness of extrapolating published COHAI estimates in their own research. Accurate methodologies would produce COHAI estimates of better quality, and provide better support for the decision-making process in infection control.

Table III
Changes in analytical methodologies for estimating additional healthcare cost of hospital-acquired infection (HAI) ($N = 89$)

	Year of publication			*P*-value
	1980–1989 ($N = 10$)	1990–1999 ($N = 21$)	2000–2006 ($N = 58$)	
Analytic approaches for estimating cost of HAI				0.033
Case review	3 (30%)	1 (4.8%)	3 (5.2%)	
Matched comparison	6 (60%)	15 (71.4%)	32 (55.2%)	
Regression analysis	0	3 (14.3%)	20 (34.5%)	
Unknown	0	1 (4.8%)	2 (3.4%)	
Unmatched comparison	1 (10%)	1 (4.8%)	1 (1.7%)	
Adjustment by length of stay				0.058
Adjusted by LOS	0 (0%)	6 (28.6%)	21 (36.2%)	
Not adjusted	10 (100%)	15 (71.4%)	37 (63.8%)	

LOS, length of stay.
Statistical analysis conducted using Fisher's exact test.

Conflict of interest statement
None declared.

Funding sources
None.

Appendix. Studies used in systematic review

A1 Herwaldt LA, Cullen JJ, Scholz D, *et al.* A prospective study of outcomes, healthcare resource utilization, and costs associated with postoperative nosocomial infections. *Infect Control Hosp Epidemiol* 2006;**27**:1291–1298.
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Please cite this article in press as: Fukuda H, et al., Variations in analytical methodology for estimating costs of hospital-acquired infections: a systematic review, Journal of Hospital Infection (2010), doi:10.1016/j.jhin.2010.10.006

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Please cite this article in press as: Fukuda H, et al., Variations in analytical methodology for estimating costs of hospital-acquired infections: a systematic review, Journal of Hospital Infection (2010), doi:10.1016/j.jhin.2010.10.006

国民健康保険世帯保険料の将来推計.

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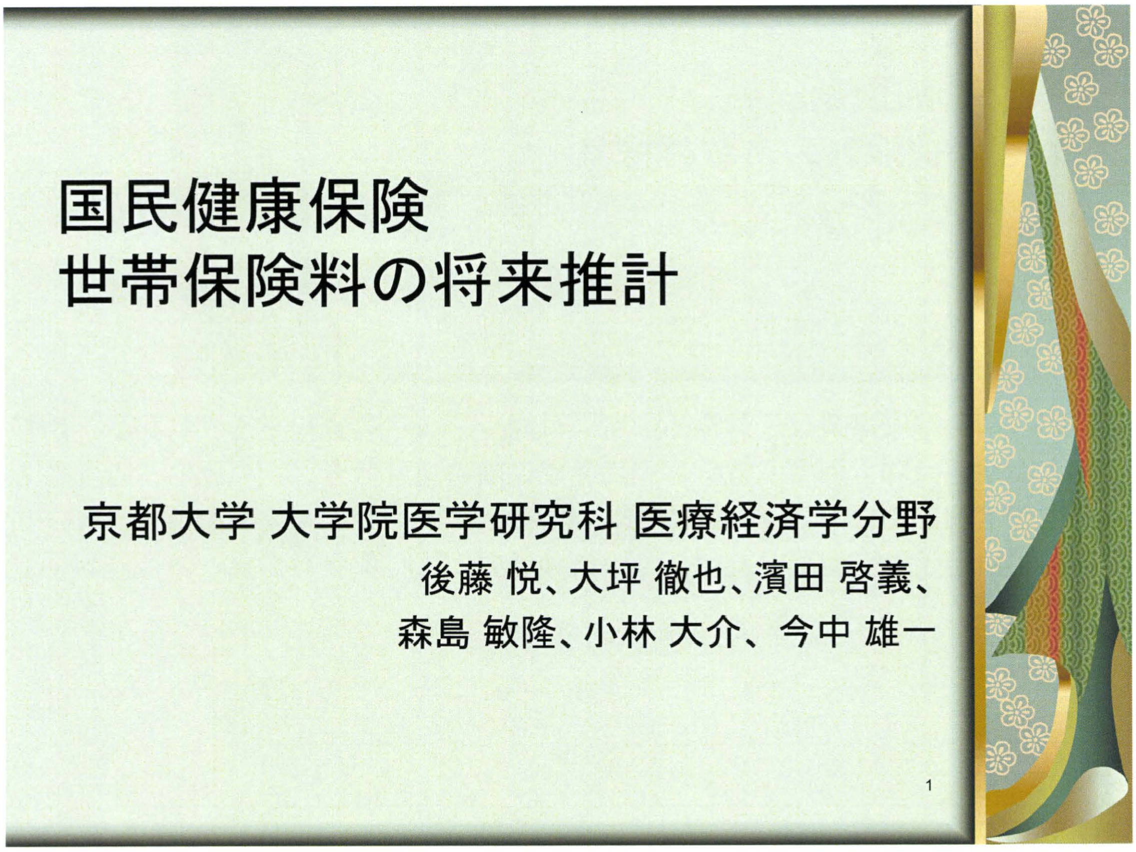
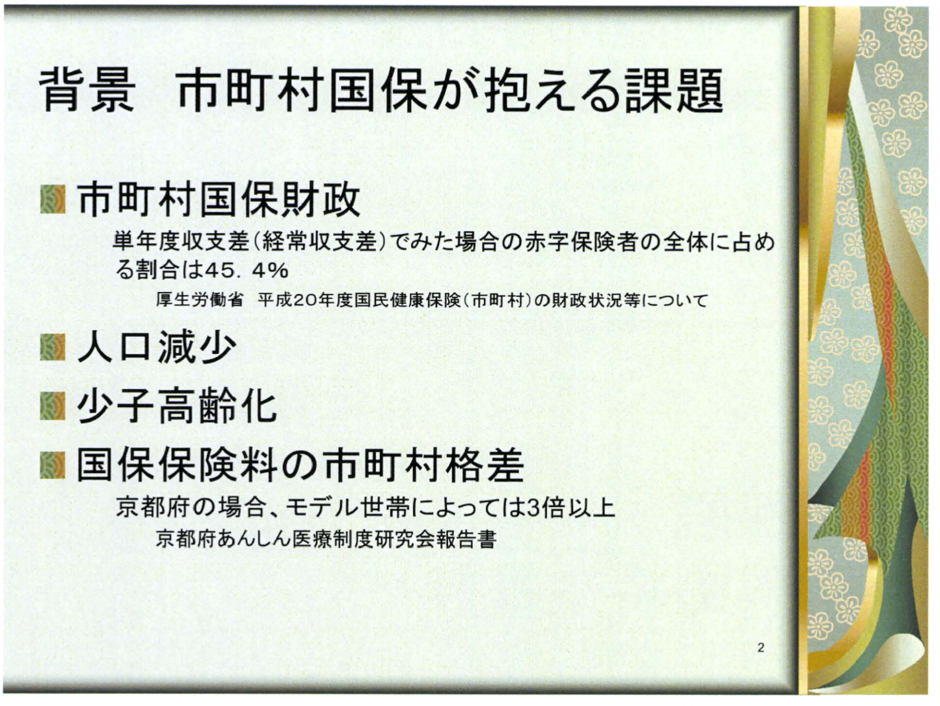
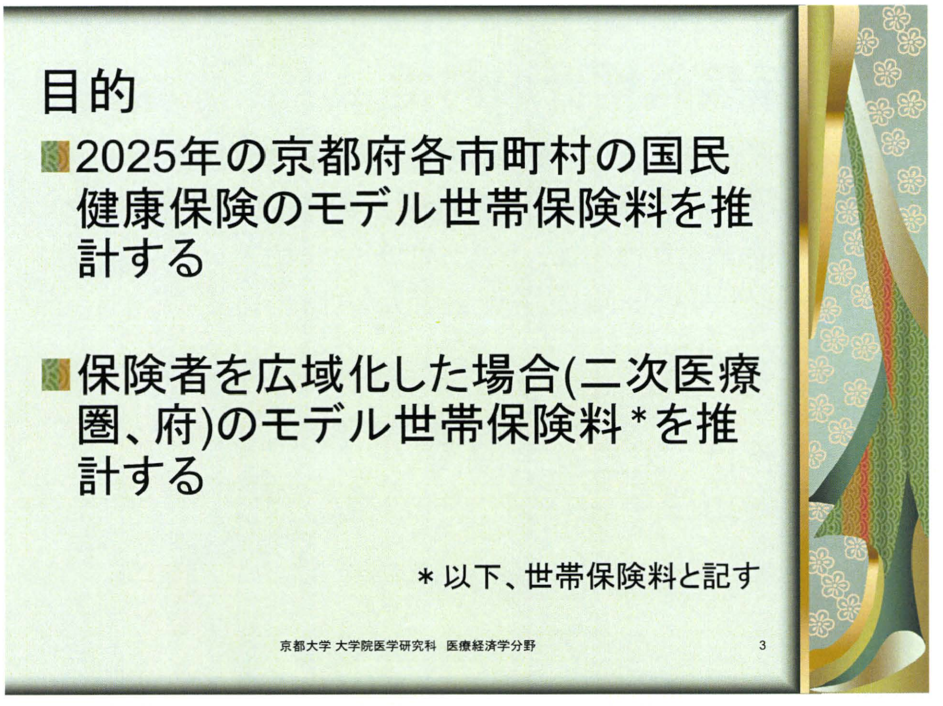
第 50 回 全国国保地域医療学会
京都, 2010 年 10 月 8 日



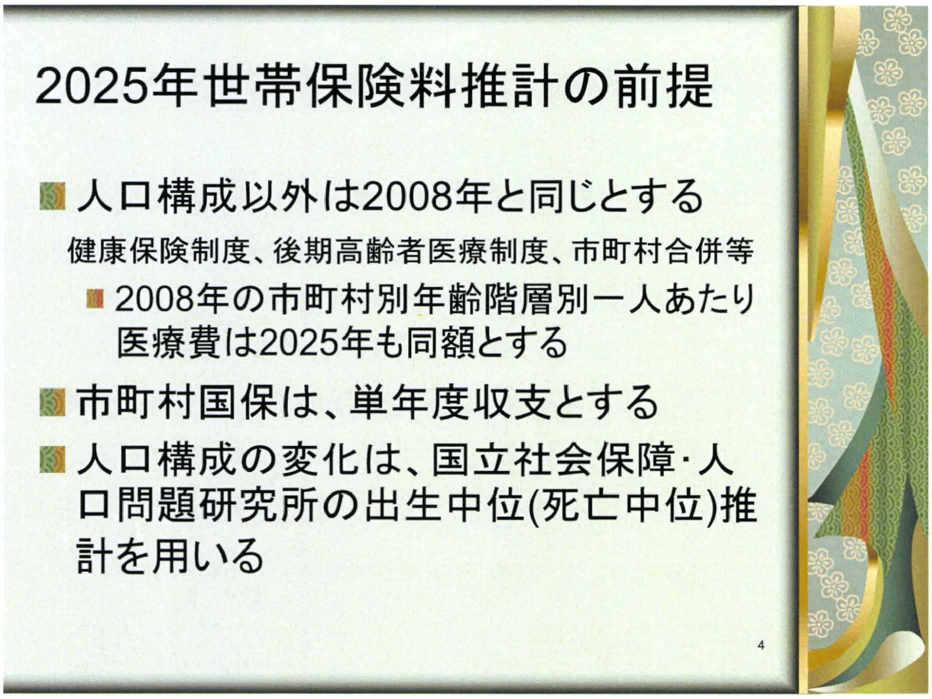


市町村国民健康保険は、将来的にも人口減少・少子高齢化とそれに伴い、財政運営の楽観は許されず、市町村国民健康保険の運営は今以上に厳しくなることが予想されます。

また、所得水準が同じでも住んでいる地域によって保険料が異なる問題があります。



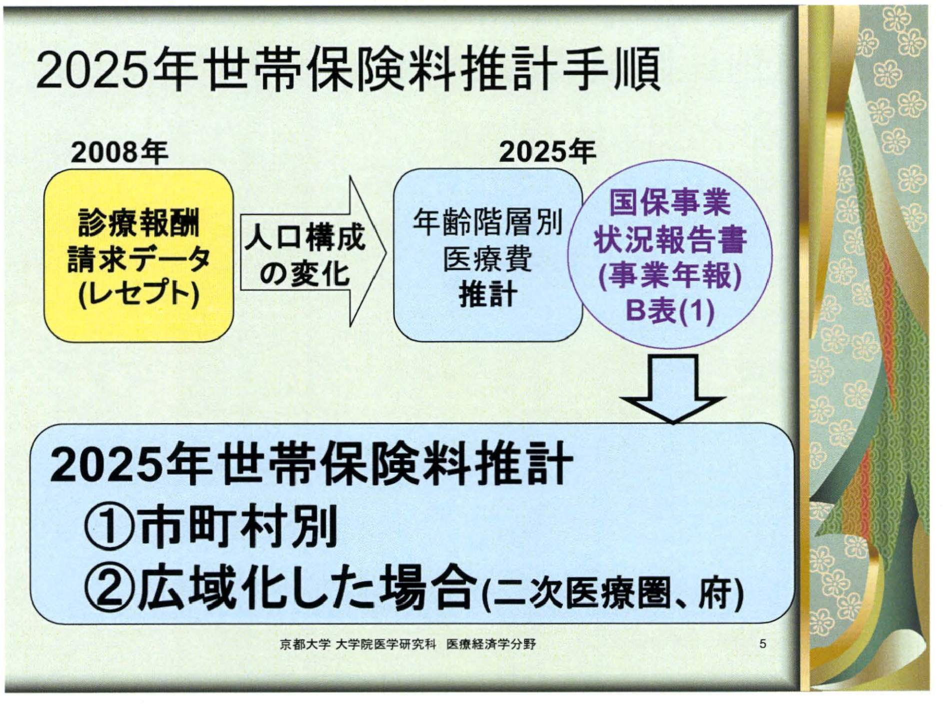
国民健康保険は、国民皆保険制度の最後の砦として重要であり、これを将来にも存続させることは、国民的合意であると考えます。
市町村国保の確かな将来像を描くためには、将来において市町村国保の財政状況や世帯保険料がどのようになるかを推計し、それを元に、保険者の広域化や制度の改革等を検討することが大事だと考えます。
そこで、本研究では、京都府および京都府国民健康保険団体連合会からデータ提供をいただき、2025 年の京都府各市町村の国民健康保険の世帯保険料の推計、ならびに、2025 年で市町村国保が広域化された場合の、世帯保険料の推計を行いました。
ここでは、その方法ならびに結果の一部を紹介させていただきます。



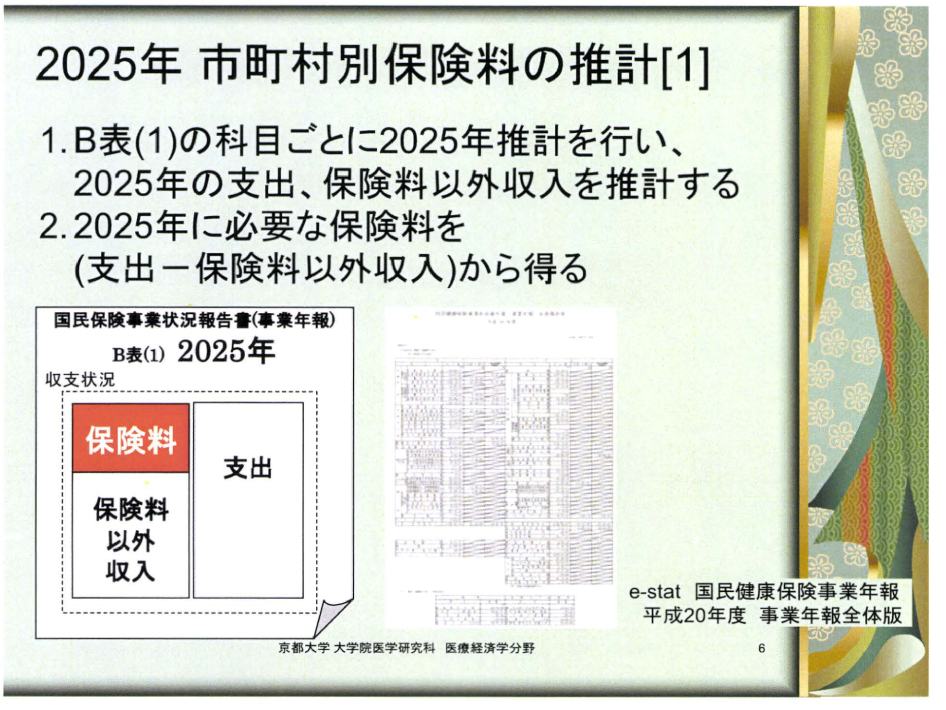
推計の前提ですが、推計にはいくつかの仮定を置いています。

一つは、2025 年の社会像についてです。技術進歩や、産業構造、経済状況の変化は当然ありうるのですが、人口構成以外は 2008 年と同じであると考えます。2025 年の医療費の推計においても、2008 年の年齢階層別一人あたり医療費が同じとして推計を行います。市町村国保は赤字補填のため、基金や積立金の取り崩しを行っておりますが、それらを考慮せず、単年度の収支で 2025 年の保険料を推計します。

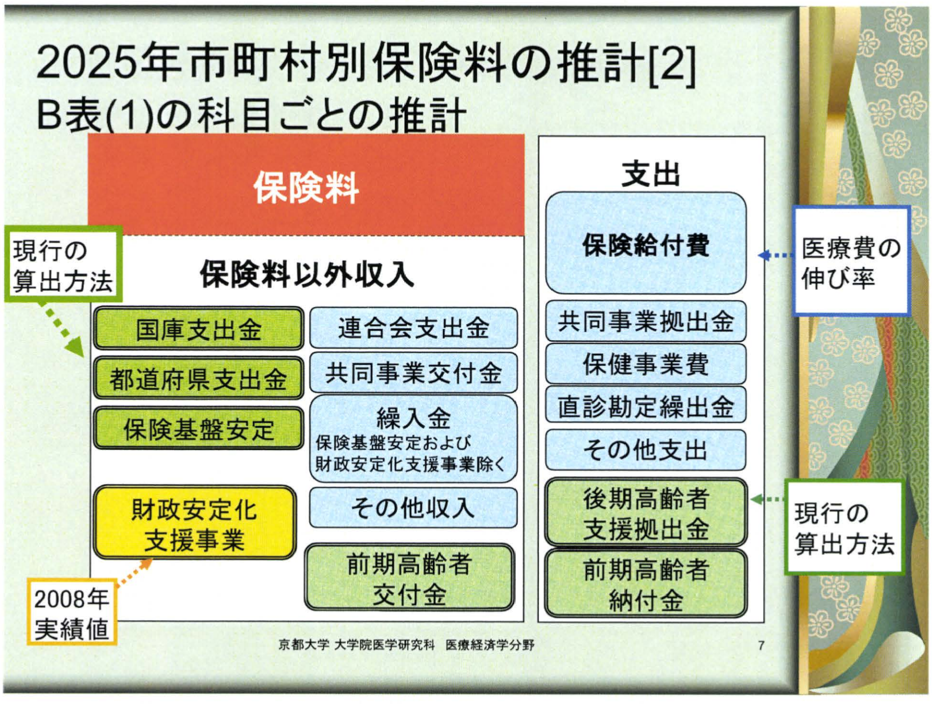
人口構成の変化は、国立社会保障・人口問題研究所の推計を用います。



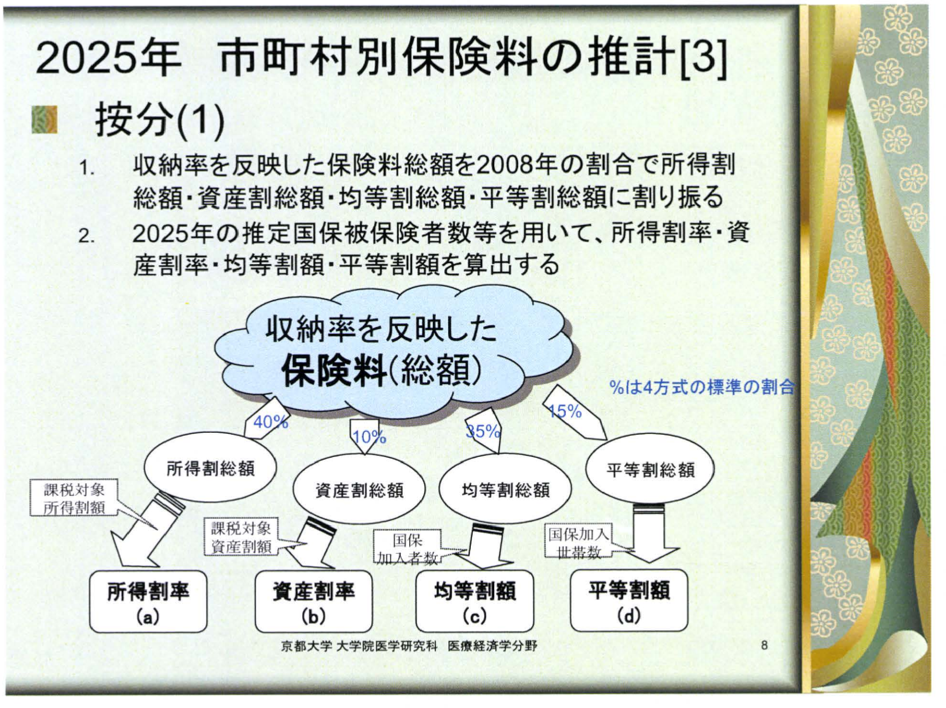
次に、世帯保険料推計手順について述べます。
2008年の診療報酬請求データ、いわゆるレセプトデータから、市町村別に年齢階層別一人あたり医療費を算出し、その後、人口推計を元に、2025年の市町村別医療費を推計します。
また2008年の国民健康保険事業報告書B表(1)の科目を、医療費の伸び率等を用いて推計し、2025年の世帯保険料を推計します。
保険料は、先ず、市町村別に。次に、二次医療圏または府に広域化した場合を推計します。



国民健康保健事業報告書B表(1)から保険料を推計する方法ですが、国民健康保健国保事業報告書B表(1)はご覧のように、支出と収入が分かるようになっています。収入は大きく分けて保険料と保険料以外です。2025年の支出と保険料以外の収入を推計し、引き算することで2025年の保険料を得ます。

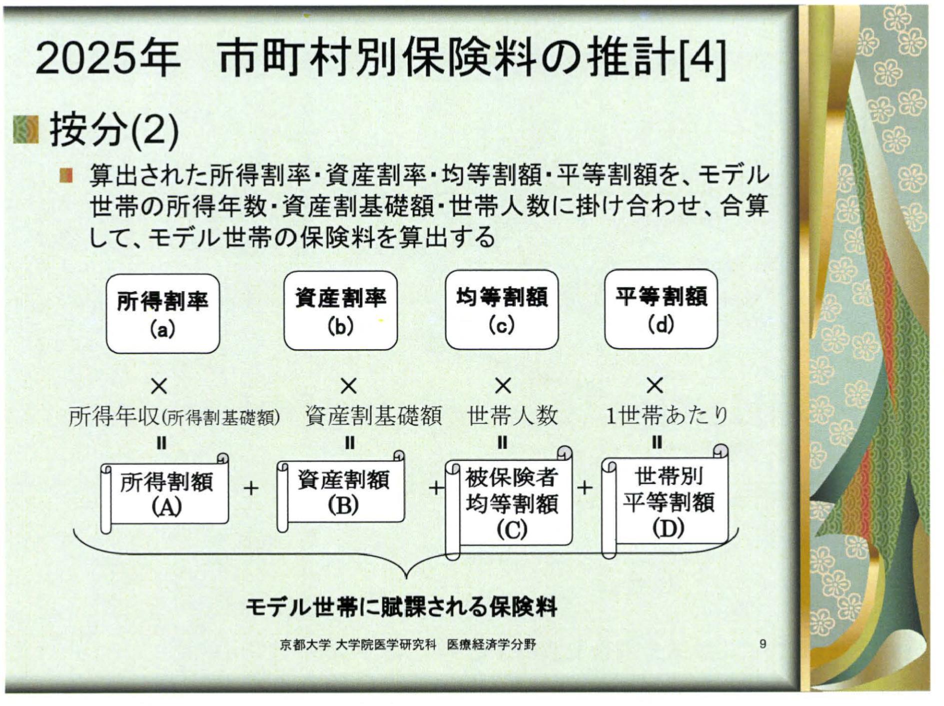


B表の推計方法ですが、科目ごとに2025年の額を推計します。ここで介護に関する費用は含めません。
支出では、保険給付費と共同事業拠出金等、医療費の伸び率で2008年の値から増減します。前期、後期高齢者への支援金等は、若干簡略化しておりますが、2008年の計算式に2025年の推計値を投入して推計します。
収入では、保険料以外収入を推計します。支出同様、医療費の伸び率で推計する科目と、現行の算出方法で推計する科目があります。財政安定化事業は2008年の実績値をそのまま用いる科目としました。
このように推計しました2025年の支出から、保険料以外の収入を引いて2025年に必要な保険料を計算します。

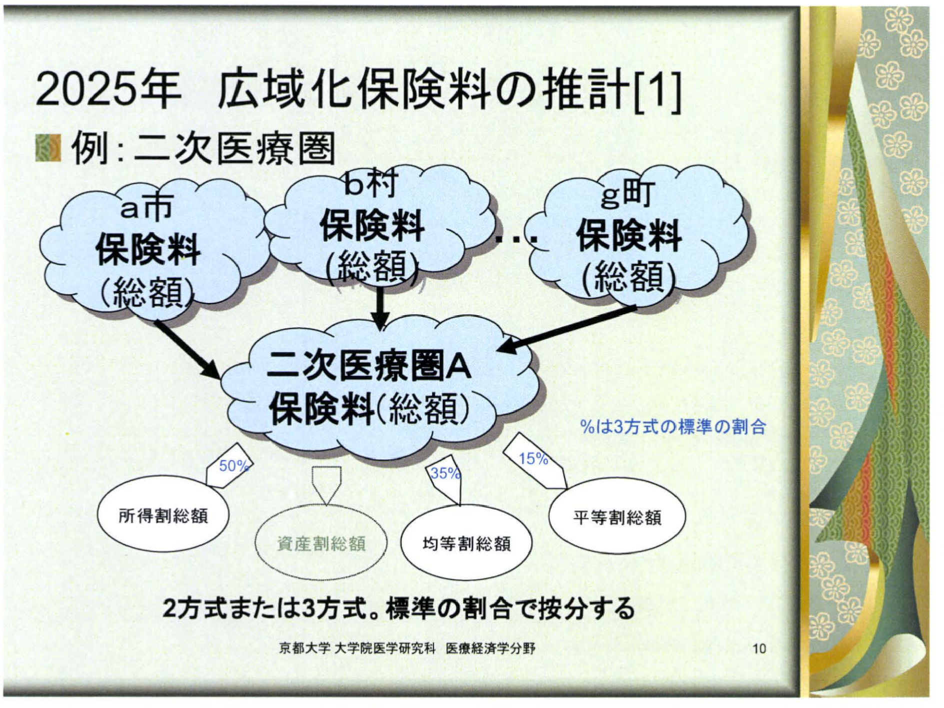


2025年に必要な保険料が定まったら､収納率を反映させて､世帯に按分します。按分の方法は2008年と同様に行います。収納率を反映した保険料を、4方式ならば4つ(所得割、資産割、均等割、平等割総額)に分けます。

所得割総額、資産割総額、均等割総額、平等割総額は、それぞれ課税対象所得割額、課税対象資産割額、国保加入者数、国保加入世帯数で割り、所得割率、資産割率、均等割、平等割額を算出します。これらは保険料を決める時の単価のようなものです。



先程、求めました単価に相当する数値、すなわち所得割率、資産割率、均等割、平等割額に、量に相当するモデル世帯の年収や世帯人数を掛け合わせ、モデル世帯の保険料を出します。



広域化した場合の、世帯保険料の推計は、収納率を考慮した保険料総額を、たとえば二次医療圏Ａならば、Aに属する市町村で合計し、市町村国保と同様に按分していきます。

ただし、広域化の場合は、２方式または３方式とし、その応益、応能の割合は１：１、標準の割合で、所得割や均等割に按分されるとします。